HYDROLOGICAL SUMMARY FOR GREAT BRITAIN - JUNE 1990

Data for this review have been provided principally by the regional divisions of the National Rivers Authority in England and Wales, the River Purification Boards in Scotland and by the Meteorological Office. The recent areal rainfall figures are derived from a restricted network of raingauges and a significant proportion of the river flow data may be subject to revision following reviews of the low flow stage-discharge relations.

For a fuller appreciation of the water resources implications, this hydrological review should be considered alongside assessments of the current reservoir storage and water demand situations in each region.

SUMMARY

As with the preceding winter and spring, the change of season heralded a relatively abrupt change in weather patterns at the end of May. In contrast to much of 1990, June was cool and cloudy. It was also a wet month in most areas, especially in Scotland where, after a brief respite, very wet conditions returned. In meteorological and agricultural terms an amelioration in drought conditions could be recognised in all regions. In England and Wales moderately severe rainfall deficiencies exist over the March-June period but regional rainfall totals since last October, and over the last year, are within the normal range. Moderate shortfalls are evident over the longer term. At the district and local scales, long term deficiencies of a substantial magnitude may still be recognised especially along parts of the eastern seaboard.

Sustained high rates of evaporation over much of Britain have contributed to a hydrological - and water resources - situation which is somewhat less reassuring than the medium term rainfall figures alone might indicate. With evaporation rates and soil moisture deficits (SMDs) remaining high, the hydrological impact of the June rainfall was limited, especially in the east. Here, and in some central districts, runoff in June was exceptionally low. Elsewhere, the steep decline in monthly runoff rates since February was arrested and monthly mean flows were broadly similar to those registered in May. This interruption in the seasonal decline in flows left discharge rates significantly above the corresponding level in 1976 in most areas. Accumulated catchment runoff totals, expressed as a percentage of the average, display extreme temporal and spatial variability. Notably high values characterise parts of Scotland and major deficiencies typify catchments in eastern and southern Britain.

Some recharge was reported in western, and a few central, aquifer units but generally the seasonal decline in groundwater levels continued. Typically, water-tables stand well below average and below the corresponding levels in 1989 but substantially above the 1976 levels. In some eastern districts, however, the long-term paucity of recharge has led to severely depressed groundwater levels; many boreholes are at their lowest June level since the 1976 drought. In the absence of an inordinately wet summer no significant improvement in the groundwater situation may be expected before evaporation rates decline in the autumn.

The timing and magnitude of the recovery in runoff and recharge rates as evaporative losses decline in the autumn will largely determine the medium and longer term water resources prospects.

RAINFALL

A sequence of low pressure systems brought widespread rainfall to all regions in June. Regional and local variations in intensity and duration were considerable. Nonetheless, rainfall totals exceeded the average in all areas apart from parts of East Anglia and central southern England where a few localities registered below 70% of the 1941-70 mean. Conversely a few districts in Scotland recorded more than twice their June average. (Table 1).[1]

For England and Wales as a whole and for most regions within them, the June rainfall total approached that for the preceding three months. Thus in rainfall terms and on a regional basis, the intensity of the drought which began in late-February was considerably reduced; return periods for all regions being below 50 years for the March-June period. Provisional data suggest that accumulated rainfall for England and Wales since February is still amongst the driest half dozen such sequences this century. For the Thames catchment only 1938, 1976 and, possibly, 1929 have been drier. The rainfall deficits in most areas become barely significant as the 1989/90 winter rainfalls are incorporated. Accumulations beginning in January 1990 (not shown in Table 2) and October 1989 give regional rainfall totals within the normal range. On a 12-month basis, a similar picture emerges albeit with rainfall totals for the Northumbria, Yorkshire and Anglia regions being appreciably below average. Longer term rainfall deficiencies remain significant in some eastern regions and constitute a substantial meteorological drought in a number of localities, mostly near the coast, where rain-shadow influences have been extraordinarily persistent (examples include parts of Kent, Lincolnshire, Humberside and - despite the June rainfall - some low-lying districts in the North-East).

For Scotland as a whole, May has been the only month this year with below average rainfall. The half-year total is remarkable; provisional figures indicate that the January-June rainfall is about 160% of the long-term average and is significantly greater than the 1989 total which itself was the highest in the Scottish general rainfall series (which begins in 1869). Accumulated rainfall totals for the Highland and Clyde River Purification Board areas are even more remarkable[2]- see Table 2. The abundant rainfall has been accompanied by a long-term exaggeration in the west-to-east rainfall gradient. As a consequence the regional accumulations tend to obscure some large local rainfall deficiencies, notably in the North East River Purification Board Area.

EVAPORATION AND SOIL MOISTURE DEFICIT

Temperatures and sunshine hours were below average in June. As a consequence the normal seasonal increase in potential evaporation rates and in SMDs failed to materialise. Nonetheless, the exceptionally high end-of-spring deficits registered over wide areas in May were maintained as soil moisture conditions remained relatively stable through June. Western Scotland was an exception to the general pattern; soils returned to field capacity around mid-month; some reduction in deficits also typified western hills in England. At the end of June, large parts of lowland England had computed deficiencies exceeding 100 mm and positive anomalies (relative to the end-of-June mean) of at least 40 mm were widespread.

The notably high SMDs are a consequence of the elevated evaporation rates which have obtained for many months. For example, over the October 1989-June 1990 period, record or near record PE totals (based on the MORECS data) have been registered throughout much of England and eastern Scotland. Sustained high SMDs have mitigated the actual evaporation

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[1] The quality control of the 1989 rainfall data has been recently completed by the Meteorological Office. For reference purposes the definitive areal figures are given in Appendix A (and have been included in this present report).

[2] In recognition of the provisional nature of the data and the uncertainties involved in the estimation procedure return periods are quoted to a maximum of 200 years only.

losses in eastern areas but, in the west, AE losses have often exceeded previous maxima in a series which commences in 1961. In the North-West, for instance, the nine-month AE total of 370 mm (80 mm above average) for the MORECS square embracing much of the Lune catchment exceeded the figure for the corresponding period in 1988/89 - itself unusually high. Clearly, were such elevated evaporation losses to become a regular occurrence, the water resources implications would be considerable.

The high SMDs will inhibit recharge well into the autumn; as a result of the exceptional evaporation losses - extending well over two years in some regions - the impact of relatively modest rainfall deficiencies has, in hydrological terms, been reinforced.

RIVER FLOWS

Baseflows continued to decline through June in almost all areas. Significant, if intermittent, surface runoff provided a counterbalance however and the normal seasonal decrease in runoff totals from May to June was barely discernible in many catchments. In a few small rivers a healthy increase in runoff rates were recorded, for instance at the Cefn Brwyn gauging station on the Wye in central Wales. With the exception of much of Scotland, most flow rates remained low to exceptionally low. Significant local variations in response to the June rainfall were apparent, reflecting its intensity, the prevailing SMDs and geological contrasts between catchments. In much of lowland Britain, June runoff totals were the lowest since 1976. In some eastern, and a few central catchments (notably the Derbyshire Derwent), flows approached or fell below those recorded during the Great Drought of 1976. Generally, however, June runoff totals were several times greater than in 1976.

Accumulated runoff totals for the four months since February exhibit a remarkable spatial polarisation. Rivers draining from the Scottish Highlands have reported extremely high runoff totals - often unprecedented. Conversely in parts of lowland and eastern Britain the March-June runoff totals are amongst the lowest on record. Echoes of this contrast are present in the longer term accumulations but in England and Wales, runoff in most rivers fall within the normal range over the 6, 9 and 12-month timeframes. Important exceptions to this generalisation may be found, particularly, in eastern rivers sustained mostly from baseflow (see for instance the Lincolnshire Lud and Yorkshire Derwent). In such catchments flow rates have been depressed for extended periods. For example, on the Derwent June was the 21st consecutive month with below average runoff; there is no precedent for such an extended period with runoff rates only half the long term average. Notably low 20-month accumulations may also be found in a number of south-eastern rivers. The contrast with Scottish rivers which drain the western highlands is a persistent feature; runoff totals for the period commencing April 1988 are the highest on record for the Tay and the Earn. The Dee (at Park), more fully reflecting the eastern rain shadow, provides evidence for depressed flow rates for much of the last twenty months, paralleling the English conditions.

GROUNDWATER

Although limited and localised fissure recharge was reported from a few areas, little or no significant recharge occurred throughout most major aquifer units in June. The recessions which commenced generally in late February continued. By month-end most index boreholes were recording levels in the lower quartile range for June. In eastern Yorkshire, parts of East Anglia, and eastern Kent, water-tables are especially low and may approach recorded minima by the end of the summer.

In north-western England, the Midlands and the South the heavy rainfall of February and March caused a very rapid rise in groundwater levels, in some cases approaching maximum recorded levels. However, in May and June, levels tended to fall almost equally rapidly to values which are currently below the seasonal norm. It is already realised that, where the winter rainfall is restricted in duration, it is generally more beneficial if it occurs later rather than earlier. Figure 5 illustrates this point: the 1989 and 1990 groundwater level traces for two index boreholes are

compared. The benefit of the late, albeit limited, recharge in 1989 relative to the early cessation in 1990 is clearly evident. It also now appears possible that where recharge is concentrated into a period of a few weeks, even with exceptionally heavy precipitation, the increase in resources may be more somewhat less than the recorded rise in groundwater levels suggest. It is possible that in those aquifers which, while dominantly of a fissured character, still have a significant intergranular storage, short periods of rainfall, however heavy, are insufficient to recharge the intergranular portions; consequently, the recession rate is rapid. This is because outflow from intergranular storage is not available to reinforce the fissure discharge

Groundwater levels in index boreholes are currently above, often significantly, those registered at the same time in 1976, with the exception of the Dalton Holme borehole (Humberside). The data presented in Table 4 suggest that such June levels would be expected, on average, only once in 10-20 years. Throughout much of lowland England groundwater recessions are a month or so in advance of those recorded last year. If, as happened in 1988 and 1989, the onset of significant recharge is inordinately delayed, water-tables will be very depressed towards the end of the year.

Institute of Hydrology / British Geological Survey **12 July 1990**

TABLE 1 1989/90 RAINFALL AS A PERCENTAGE OF THE 1941-70 AVERAGE

		May 1989	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan 1990	Feb	Mar	Apr	May	Jun
England and	mm	20	55	38	58	41	98	61	134	133	142	20	38	25	72
Wales	%	30	90	52	65	49	118	63	149	154	219	34	66	37	118
NRA REGIONS															
North West	mm	37	82	33	116	29	145	84	100	196	187	47	52	49	108
	%	45	99	32	93	24	123	69	83	175	231	65	68	60	130
Northumbria	mm	22	51	19	77	20	71	35	75	111	133	33	28	51	84
	%	34	84	25	76	25	95	37	100	139	202	63	51	80	137
Severn Trent	mm	25	53	40	44	38	82	52	135	107	110	21	30	19	65
	%	39	95	62	54	57	126	66	193	155	208	40	58	30	115
Yorkshire	mm	19	69	43	41	20	77	45	98	118	112	24	24	29	90
	%	31	119	61	46	28	112	51	132	153	175	45	43	48	155
Anglia	mm	14	56	41	35	30	41	36	98	52	74	15	36	16	45
	%	30	114	72	55	58	79	58	185	101	177	37	90	34	93
Thames	mm	14	39	37	44	28	65	37	141	91	113	12	35	7	48
	%	25	75	62	63	45	102	51	214	147	242	26	76	12	92
Southern	mm	5	41	28	29	37	79	50	142	121	135	6	43	11	54
	%	9	82	54	40	52	101	53	175	159	238	11	90	20	108
Wessex	mm	21	32	37	43	49	101	58	165	124	157	15	35	13	65
	%	31	59	60	52	62	123	60	183	148	265	26	65	19	120
South West	mm	12	40	31	62	107	148	100	196	195	238	25	47	24	96
	%	14	62	37	61	103	131	75	145	151	264	30	66	29	148
Welsh	mm	25	67	48	91	62	180	109	199	240	214	37	45	33	93
	%	27	82	51	76	50	140	76	137	176	223	42	52	36	113
Scotland	mm	53	76	49	184	96	187	60	96	248	291	183	97	55	156
	%	59	83	44	143	70	126	42	62	181	280	199	108	60	170
RIVER PURIFICATION BOARDS															
Highland	mm	68	90	65	222	118	252	79	109	293	364	395	148	57	195
	%	66	82	51	150	75	135	47	56	179	274	346	130	55	177
North-East	mm	59	57	25	84	57	87	29	54	103	145	87	51	48	132
	%	77	81	27	79	66	90	28	53	114	195	140	84	62	189
Tay	mm	42	58	30	140	83	136	51	86	236	249	186	62	43	163
	%	44	70	29	119	72	111	43	64	200	270	227	83	45	196
Forth	mm	36	64	27	144	69	112	39	79	220	221	134	50	39	145
	%	43	85	28	124	64	106	36	72	222	287	194	74	46	193
Tweed	mm	43	51	23	113	47	68	30	78	166	180	53	47	46	100
	%	57	75	27	99	51	77	29	87	179	260	91	77	61	147
Solway	mm	35	71	42	176	77	145	59	119	250	282	97	50	77	106
	%	38	79	38	135	51	101	41	79	179	303	107	57	84	118
Clyde	mm	46	90	63	252	120	244	73	107	316	343	290	144	58	156
	%	47	87	48	177	69	133	44	58	196	304	276	140	60	151

Note: June figures for England and Wales for 1990 are based upon MORECS figures supplied by the Meteorological Office

Scottish RPB data for June 1990 are estimated from the isohyetal map of June rainfall in the MORECS bulletin.

TABLE 2 RAINFALL RETURN PERIOD ESTIMATES

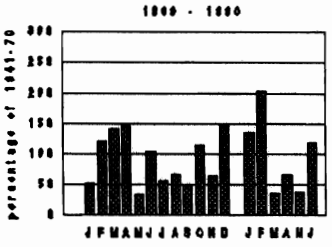
		MAR - JUN 90	Est Return Period, years	OCT 89 - JUN 90	Est Return Period, years	JUL 89 - JUN 90	Est Return Period, years	NOV 88 - JUN 90	Est Return Period, years
England and	mm	155		723		859		1340	
Wales	% LTA	63	20-30	108	2-5	94	2-5	90	5
NRA REGIONS									
North West	mm	256		968		1146		1899	
	% LTA	82	2-5	112	2-5	94	2-5	97	2-5
Northumbria	mm	196		621		737		1174	
	% LTA	84	2-5	100	<2	84	5-10	82	20-30
Severn Trent	mm	135		621		743		1150	
	% LTA	60	20-30	111	2-5	96	2-5	91	2-5
Yorkshire	mm	167		617		721		1164	
	% LTA	73	5-10	103	2-5	87	5	85	10-15
Anglia	mm	112		414		520		837	
	% LTA	64	10-20	95	2-5	85	5-10	84	10-20
Thames	mm	102		549		658		995	
	% LTA	51	30-50	107	2-5	93	2-5	86	5-10
Southern	mm	114		641		735		1088	
	% LTA	56	20-30	109	2-5	93	2-5	83	10-20
Wessex	mm	128		732		861		1273	
	% LTA	55	20-40	113	2-5	99	<2	89	5
South West	mm	192		1069		1269		1860	
	% LTA	63	10-20	118	5-10	106	2-5	94	2-5
Welsh	mm	208		1149		1350		2085	
	% LTA	60	20-40	115	5-10	101	<2	95	2-5
Scotland	mm	491		1372		1777		2774	
	% LTA	134	30-50	130	80-120	124	60-80	119	50-100
RIVER PURIFICATION BOARDS									
Highland	mm	795		1893		2298		3767	
	% LTA	180	>>200	147	>>200	133	>200	133	>>200
North-East	mm	318		736		902		1437	
	% LTA	118	5	100	<2	88	5-10	86	10-20
Tay	mm	454		1211		1464		2313	
	% LTA	136	10-20	132	40-60	117	10	113	10
Forth	mm	368		1038		1278		2022	
	% LTA	124	5-10	131	40-60	114	5-10	112	10
Tweed	mm	246		768		951		1492	
	% LTA	94	2-5	109	2-5	95	2-5	92	5
Solway	mm	330		1185		1480		2386	
	% LTA	91	2-5	115	5-10	104	2-5	103	2-5
Clyde	mm	648		1731		2083		3413	
	% LTA	159	>>200	142	>200	130	100-200	126	>200

Return period assessments are based on tables provided by the Meteorological Office*. These assume a start in a specified month; return periods for a start in any month may be expected to be an order of magnitude less. "Wet" return periods underlined.

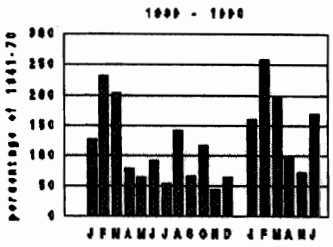
The tables reflect rainfall totals over the period 1911-70 only and the estimate assumes a sensibly stable climate.

The June 1990 RPB values are estimated from the isopleth map within the June summary published in the Met. Office's MORECS bulletin.

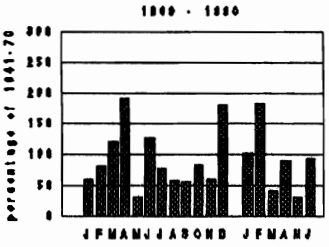
FIGURE 1. MONTHLY RAINFALL FOR 1989 – 1990 AS A PERCENTAGE OF THE 1941 – 1970 AVERAGE FOR ENGLAND AND WALES, SCOTLAND, AND THE NRA REGIONS



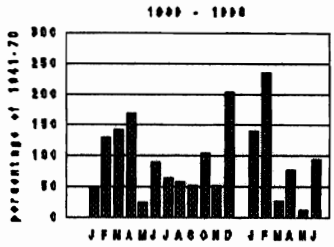
England and Wales



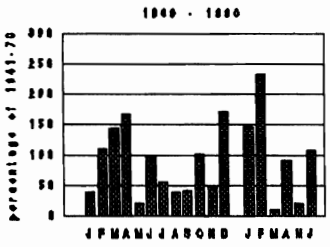
Scotland



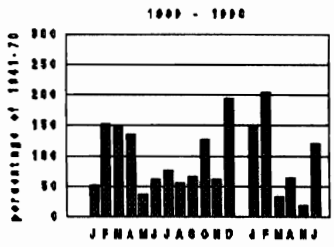
Anglian NRA Region



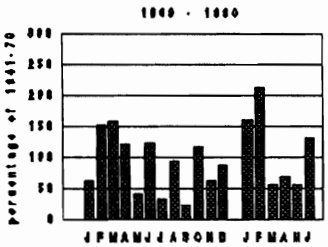
Thames NRA Region



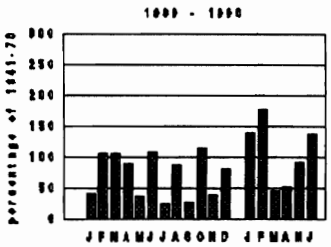
Southern NRA Region



Wessex NRA Region

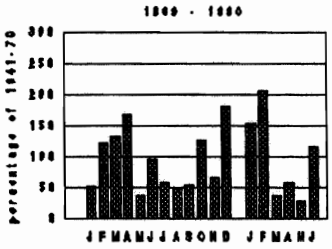


North West NRA Region

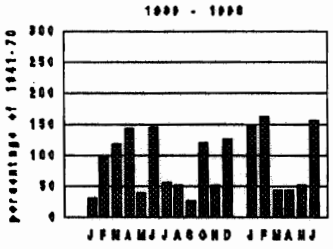


Northumbrian NRA Region

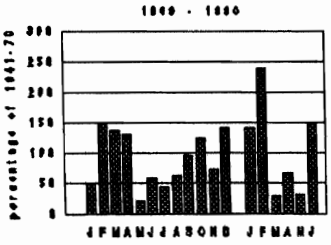
FIGURE 1 (continued)



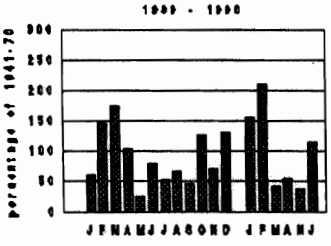
Severn-Trent NRA Region



Yorkshire NRA Region

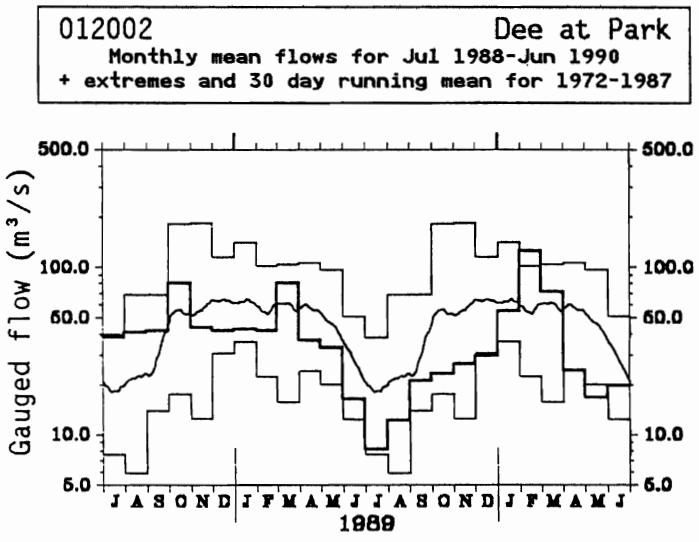


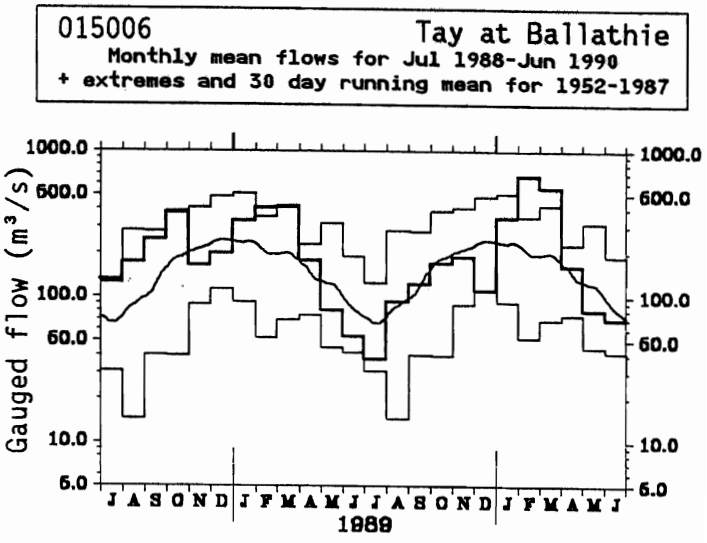
South West NRA Region

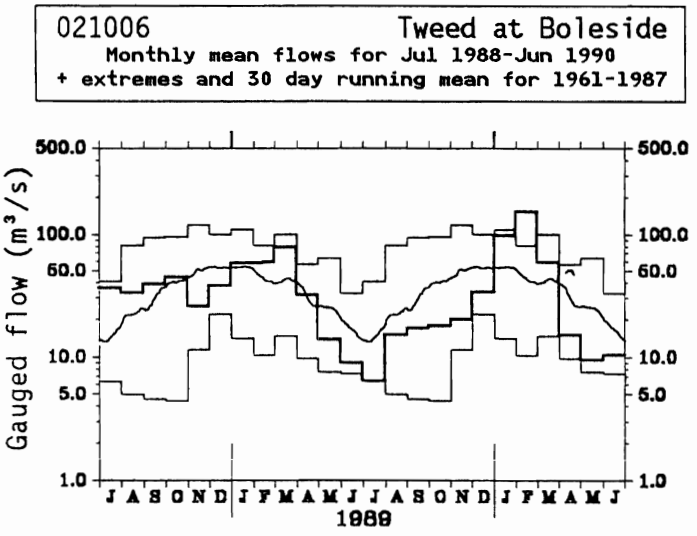


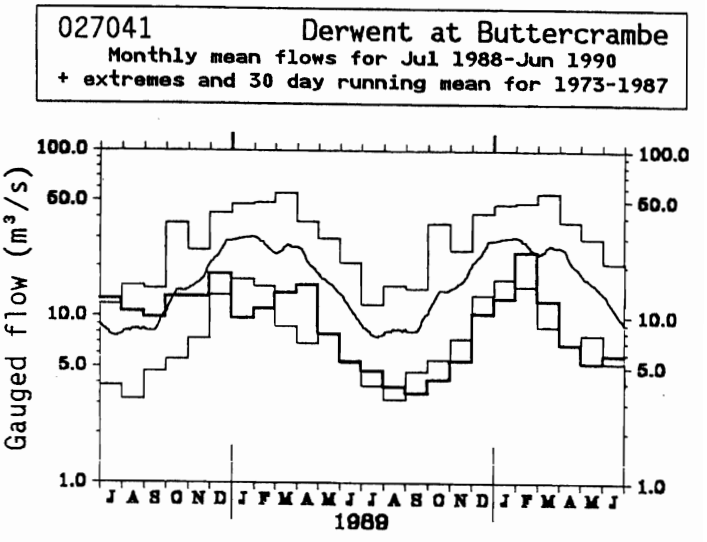
Welsh NRA Region

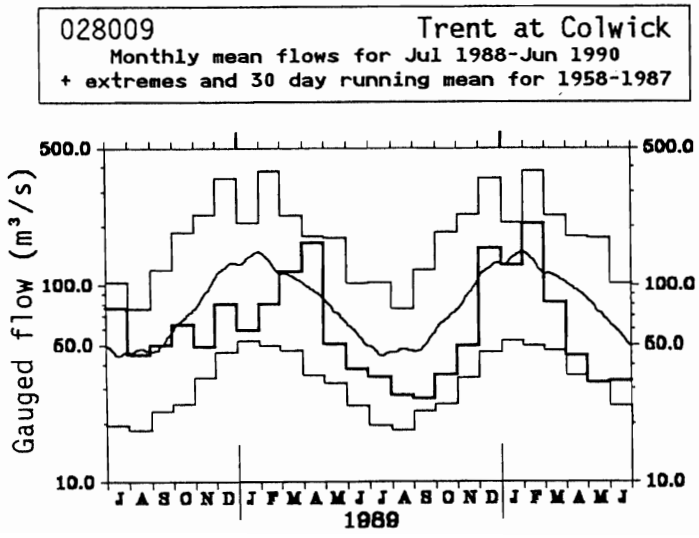
FIGURE 2 MONTHLY RIVER FLOW HYDROGRAPHS

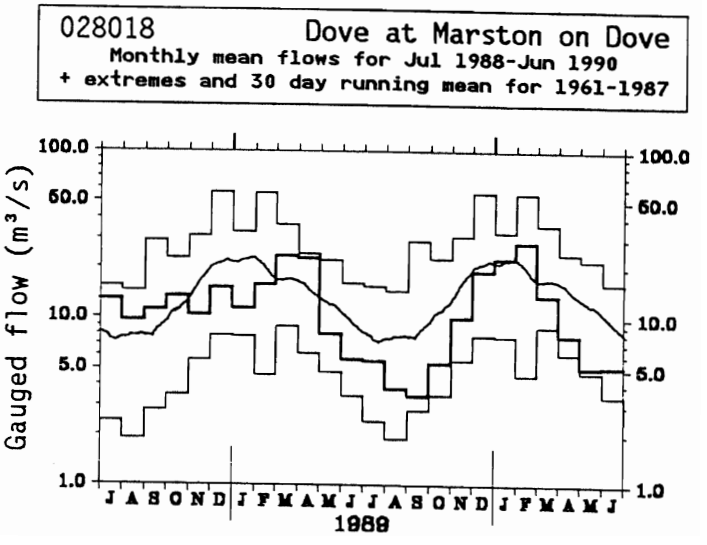






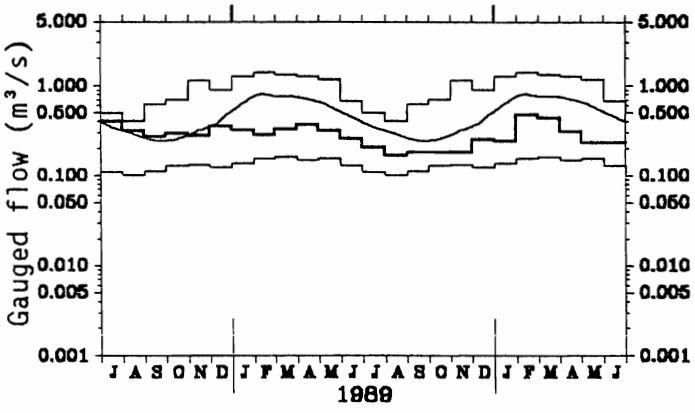






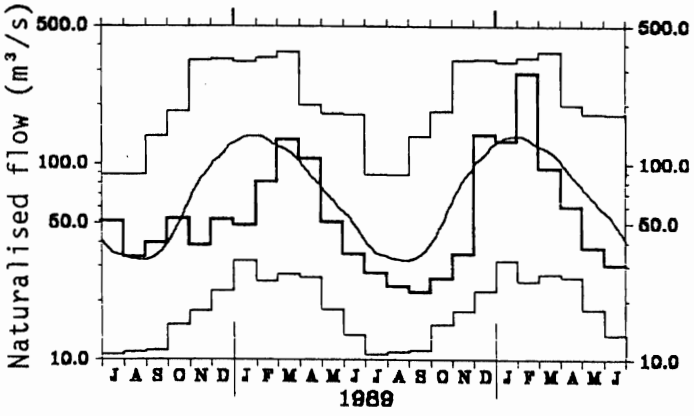
029003 Lud at Louth

Monthly mean flows for Jul 1988-Jun 1990
+ extremes and 30 day running mean for 1968-1987



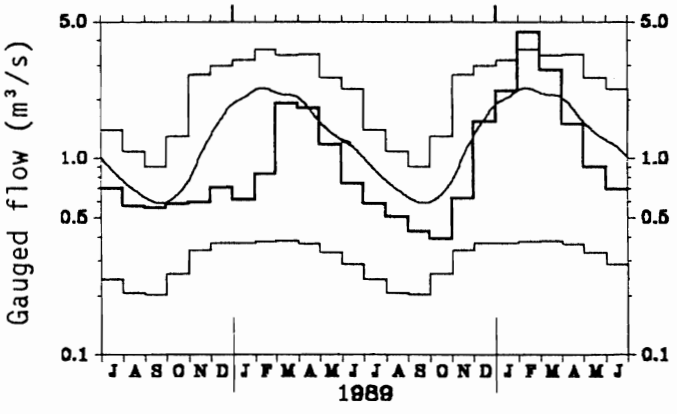
039001 Thames at Kingston

Monthly mean flows for Jul 1988-Jun 1990
+ extremes and 30 day running mean for 1883-1987



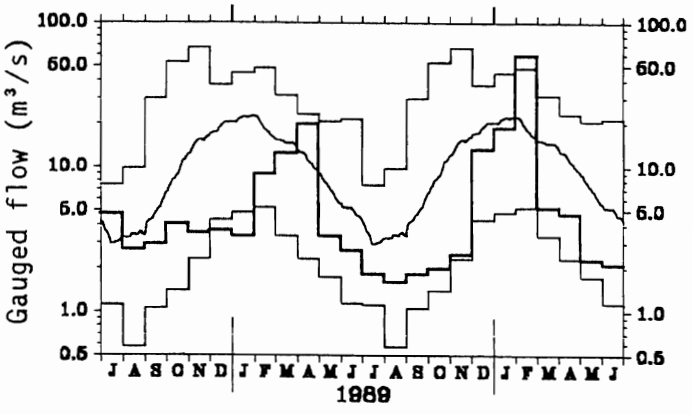
039020 Coln at Bibury

Monthly mean flows for Jul 1988-Jun 1990
+ extremes and 30 day running mean for 1963-1987



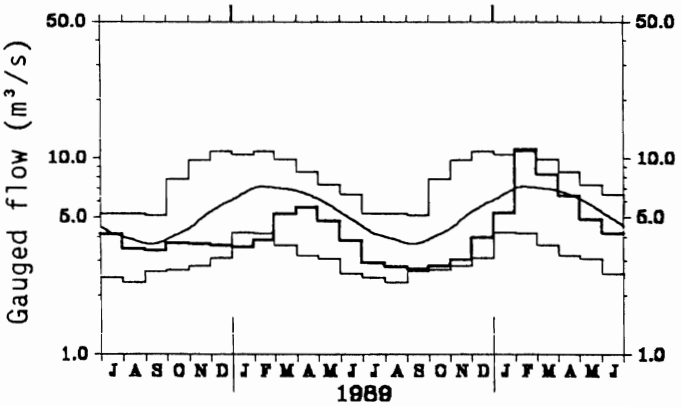
040003 Medway at Teston

Monthly mean flows for Jul 1988-Jun 1990
+ extremes and 30 day running mean for 1956-1987



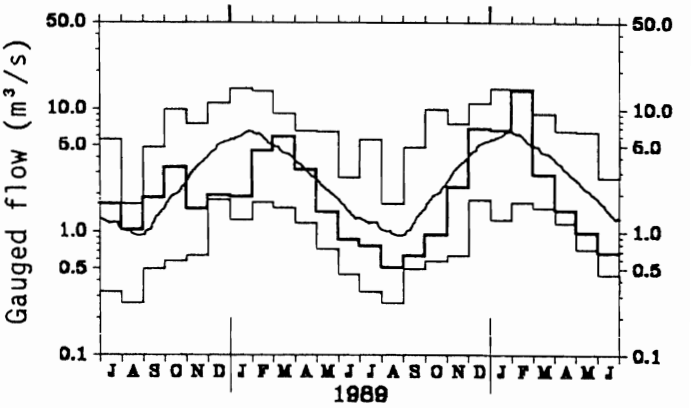
042010 Itchen at Highbridge+Allbrook

Monthly mean flows for Jul 1988-Jun 1990
+ extremes and 30 day running mean for 1958-1987



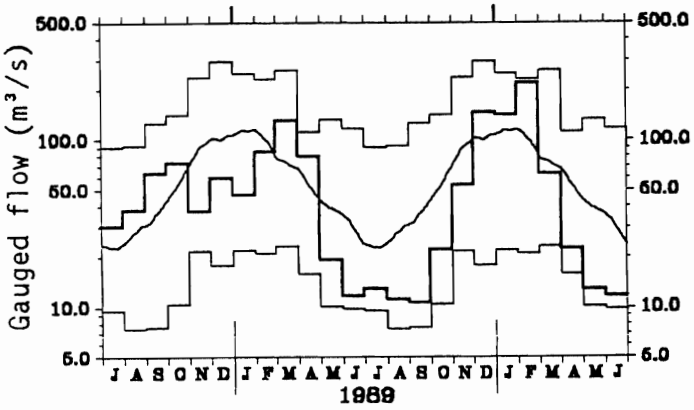
052005 Tone at Bishops Hull

Monthly mean flows for Jul 1988-Jun 1990
+ extremes and 30 day running mean for 1961-1987



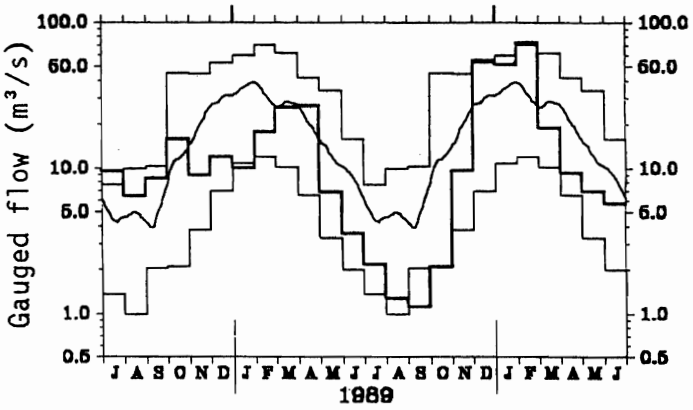
054001 Severn at Bewdley

Monthly mean flows for Jul 1988-Jun 1990
+ extremes and 30 day running mean for 1921-1987



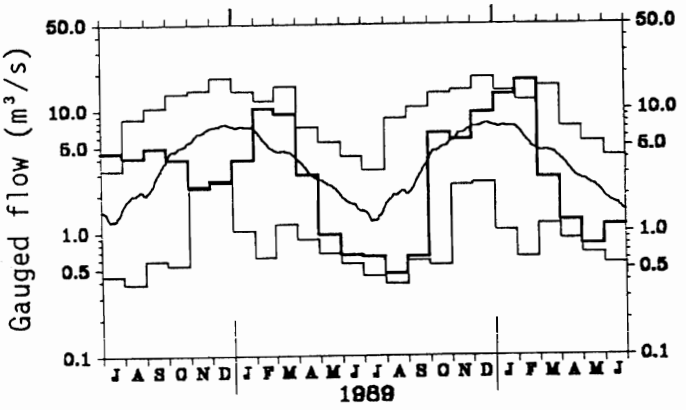
054029 Teme at Knightsford Bridge

Monthly mean flows for Jul 1988-Jun 1990
+ extremes and 30 day running mean for 1970-1987



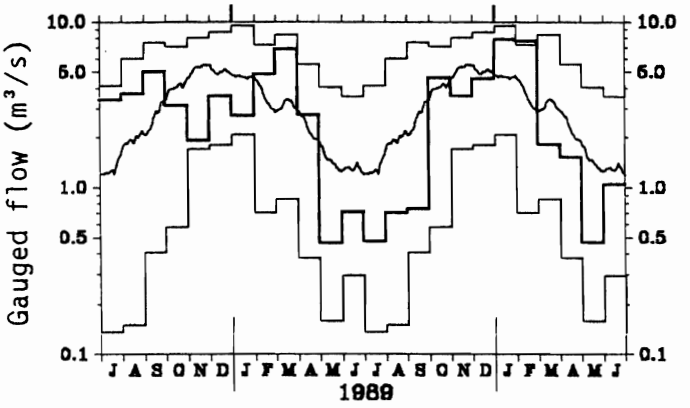
057004 Cynon at Abercynon

Monthly mean flows for Jul 1988-Jun 1990
+ extremes and 30 day running mean for 1957-1987



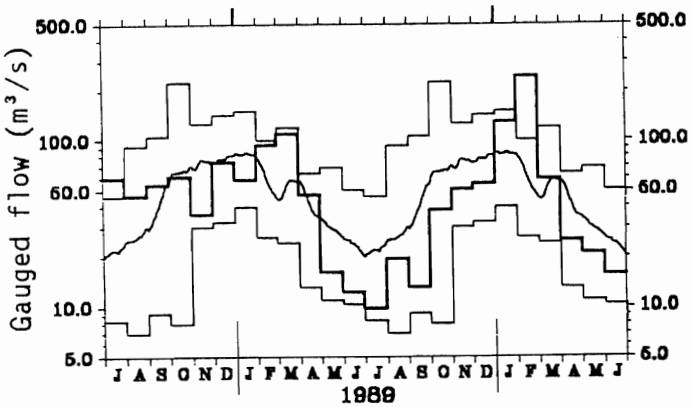
067018 Dee at New Inn

Monthly mean flows for Jul 1988-Jun 1990
+ extremes and 30 day running mean for 1969-1987



076007 Eden at Sheepmount

Monthly mean flows for Jul 1988-Jun 1990
+ extremes and 30 day running mean for 1967-1987



084013 Clyde at Daldowie

Monthly mean flows for Jul 1988-Jun 1990
+ extremes and 30 day running mean for 1963-1987

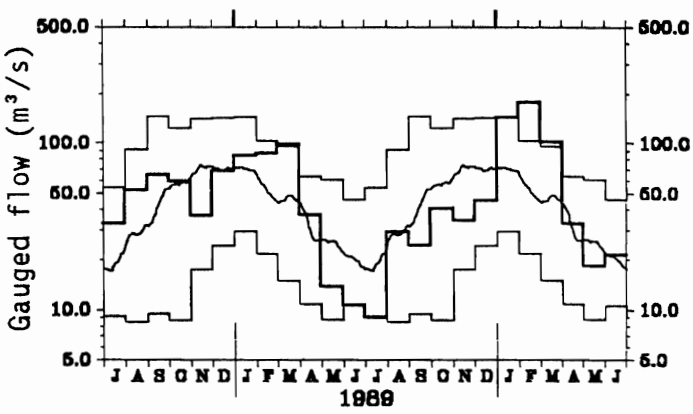


TABLE 3 RUNOFF AS MM. AND AS A PERCENTAGE OF THE PERIOD OF RECORD AVERAGE WITH SELECTED PERIODS RANKED IN THE RECORD

River/ Station name	Feb 1990	Mar	Apr	May	June 1990		3/90 to 6/90		10/89 to 6/90		7/89 to 6/90		11/88 to 6/90	
	mm %LT	mm %LT	mm %LT	mm %LT	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs	mm %LT	rank /yrs
Dee at	165	103	34	24	28	7	189	3	547	2	607	2	1086	2
Park	239	113	43	37	75	/18	70	/18	79	/17	76	/17	78	/17
Tay at	353	324	91	47	40	19	502	38	1326	37	1471	34	2500	37
Ballathie	322	268	110	67	89	/38	155	/38	139	/38	130	/37	127	/37
Tweed at	245	105	26	17	18	10	166	10	712	26	780	16	1324	12
Boleside	341	133	51	39	64	/29	83	/29	113	/29	104	/28	102	/28
Wharfe at	142	59	20	17	11	6	107	3	527	9	568	4	1037	3
Flint Mill Weir	193	78	36	44	44	/35	56	/35	87	/35	78	/34	82	/34
Derwent at	37	21	11	9	10	3	51	1	143	1	163	1	318	1
Buttercrambe	90	46	33	35	59	/17	43	/17	49	/17	48	/16	51	/16
Trent at	66	29	15	11	11	3	67	2	264	9	295	5	518	5
Colwick	154	71	45	43	57	/32	58	/32	85	/32	82	/31	80	/31
Dove at	78	41	23	15	15	4	94	3	344	4	382	3	715	3
Marston on Dove	143	75	53	42	57	/29	60	/29	80	/29	77	/27	80	/27
Lud at	21	21	15	11	11	4	58	3	119	3	146	3	265	2
Louth	59	56	45	39	53	/22	50	/22	52	/22	56	/21	55	/21
Witham at	71	17	10	6	5	24	38	16	212	31	228	31	398	27
Claypole Mill	213	54	49	45	61	/58	52	/58	105	/57	105	/57	97	/56
Colne at	35	9	7	4	4	8	25	5	94	7	105	5	204	6
Lexden	194	48	52	45	73	/31	53	/31	74	/31	75	/30	79	/30
Mimram at	15	14	12	10	8	6	45	13	92	16	113	11	193	9
Panshanger Park	128	105	94	81	73	/38	91	/38	92	/37	89	/37	88	/36
Thames at	70	25	16	10	8	25	59	27	218	53	238	49	380	30
Kingston (natr.)	213	80	71	57	63	/108	70	/108	100	/107	97	/107	84	/106
Coln at	100	71	36	23	17	6	147	10	367	12	404	9	610	6
Bibury	189	132	83	69	63	/27	93	/27	107	/27	102	/26	84	/26
Mole at	153	21	22	14	18	10	75	2	403	10	437	9	720	1
Kinnersley Manor	315	40	63	52	100	/17	57	/16	98	/15	96	/15	85	/13
Medway at	115	11	10	5	4	4	30	2	221	12	232	7	352	1
Teston	315	35	44	34	41	/32	39	/29	86	/28	83	/27	69	/24
Ouse at	132	24	20	10	9	12	63	3	309	10	336	10	511	3
Gold Bridge	278	52	58	40	58	/30	53	/30	86	/29	85	/28	71	/27
Itchen at	74	61	46	36	30	7	173	13	358	12	420	8	667	2
Highbridge+Allbrook	152	117	98	84	86	/32	98	/32	94	/32	90	/31	82	/31
Stour at	156	47	22	15	10	4	95	5	415	11	436	11	654	4
Throop Mill	281	90	63	63	63	/18	76	/18	114	/17	110	/17	88	/16
Tone at	170	38	19	13	9	2	79	3	470	20	495	17	768	6
Bishops Hull	235	65	48	46	50	/30	56	/30	108	/29	104	/29	87	/28
Brue at	125	26	12	8	7	5	54	2	376	11	392	6	662	3
Lovington	214	50	39	34	46	/26	45	/26	97	/26	88	/25	82	/25
Severn at	121	39	13	8	7	3	67	8	409	39	431	34	714	16
Bewdley	212	84	41	33	40	/70	56	/69	103	/69	95	/69	87	/68
Teme at	118	34	16	12	10	6	73	4	404	18	412	16	609	3
Knightsford Bridge	226	67	45	56	70	/21	61	/20	115	/20	110	/20	87	/19
Cynon at	393	70	30	20	28	12	148	5	1408	30	1451	23	2248	15
Abercynon	300	58	39	33	69	/32	50	/32	129	/32	115	/30	102	/30
Dee at	344	90	73	23	50	12	237	5	1594	14	1688	8	2836	5
New Inn	213	49	70	33	85	/21	58	/21	105	/21	93	/21	90	/20
Lune at	298	77	43	28	15	5	163	5	1033	21	1089	13	1899	12
Caton	322	77	58	56	37	/28	62	/28	112	/26	96	/26	98	/24
Eden at	253	68	28	24	17	8	138	7	706	16	755	12	1261	10
Sheepmount	381	99	60	73	66	/20	80	/20	119	/19	110	/18	106	/17
Clyde at	223	143	45	26	29	19	243	23	834	26	921	24	1519	22
Daldowie	318	198	109	74	110	/27	137	/27	132	/27	121	/26	116	/26

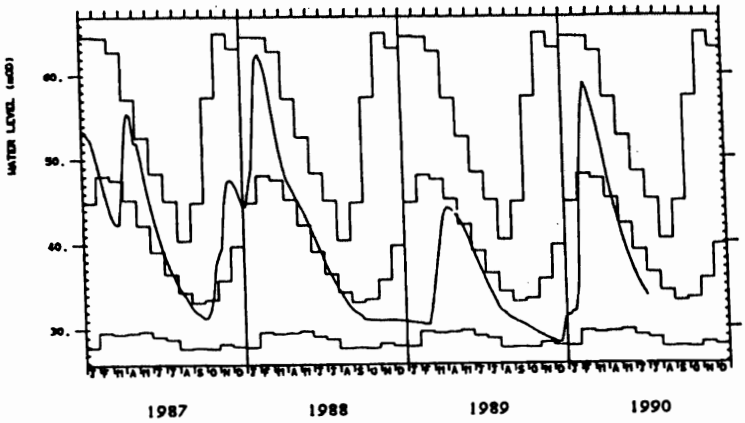
Notes (i) Values based on gauged flow data unless flagged (natr.), when naturalised data have been used.
(ii) Values are ranked so that lowest runoff as rank 1;
(iii) %LT means percentage of long term average from the start of the record to 1989. For the long periods (at the right of this table), the end date for the long term is 1990.

FIGURE 3 GROUNDWATER HYDROGRAPHS

Site name: COMPTON HOUSE

National grid reference: SU 7755 1490 Well number: SU71/23

Aquifer: CHALK AND UPPER GREENSAND Measuring level: 81.37

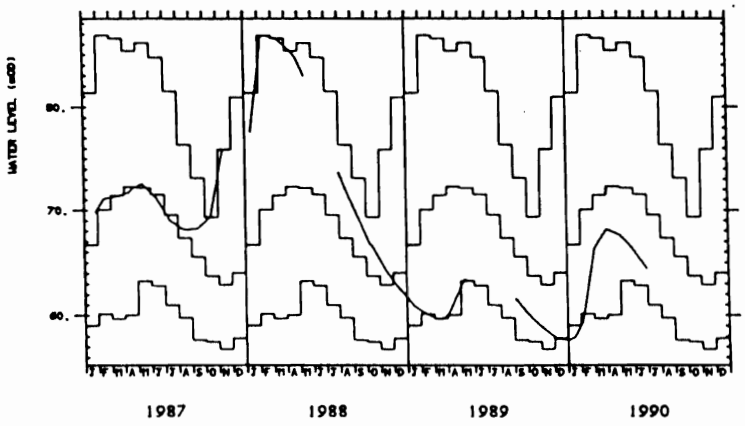


Max, Min and Mean values calculated from years 1894 TO 1989

Site name: LITTLE BUCKET FARM,WALTHAM

National grid reference: TR 1225 4690 Well number: TR14/9

Aquifer: CHALK AND UPPER GREENSAND Measuring level: 87.33



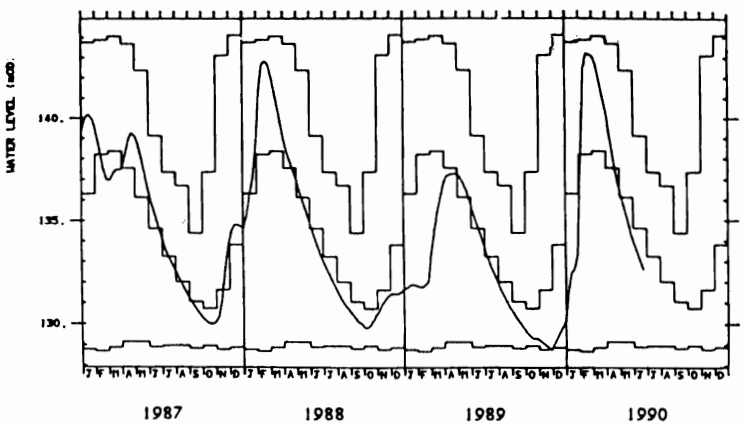
Max, Min and Mean values calculated from years 1971 TO 1989

A break in the data line indicates a recording interval of greater than 8 weeks

Site name: ROCKLEY

National grid reference: SU 1655 7174 Well number: SU17/57

Aquifer: CHALK AND UPPER GREENSAND Measuring level: 146.39

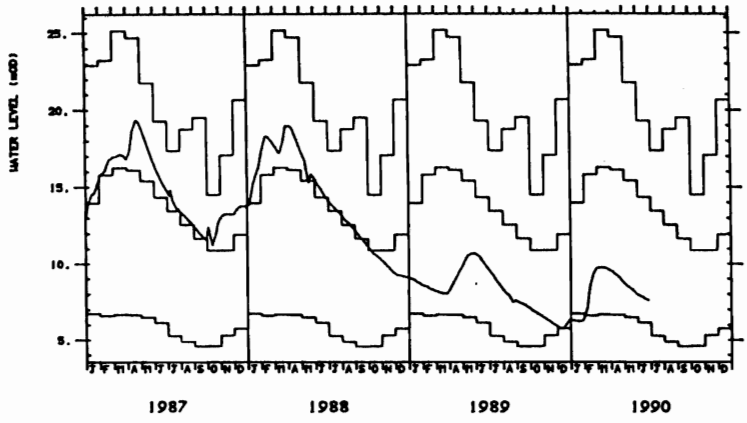


Max, Min and Mean values calculated from years 1933 TO 1989

Site name: LITTLE BROCKLESBY

National grid reference: TA 1371 0888 Well number: TA10/40

Aquifer: CHALK AND UPPER GREENSAND Measuring level: 44.33

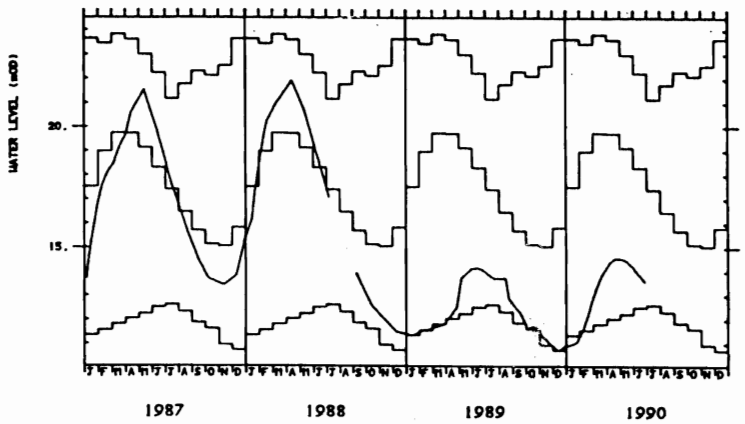


Max, Min and Mean values calculated from years 1926 TO 1989

Site name: DALTON HOLME

National grid reference: SE 9651 4530 Well number: SE94/5

Aquifer: CHALK AND UPPER GREENSAND Measuring level: 33.50



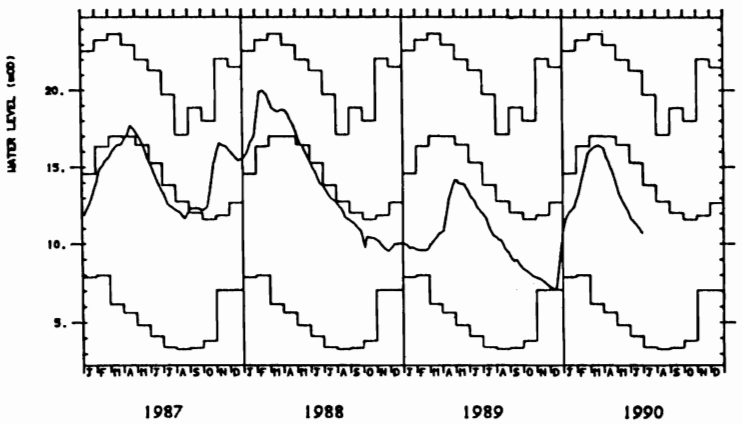
Max, Min and Mean values calculated from years 1889 TO 1989

A break in the data line indicates a recording interval of greater than 8 weeks

Site name: NEW RED LION

National grid reference: TF 0885 3034 Well number: TF03/37

Aquifer: LINCOLNSHIRE LIMESTONE Measuring level: 33.82



Max, Min and Mean values calculated from years 1964 TO 1989

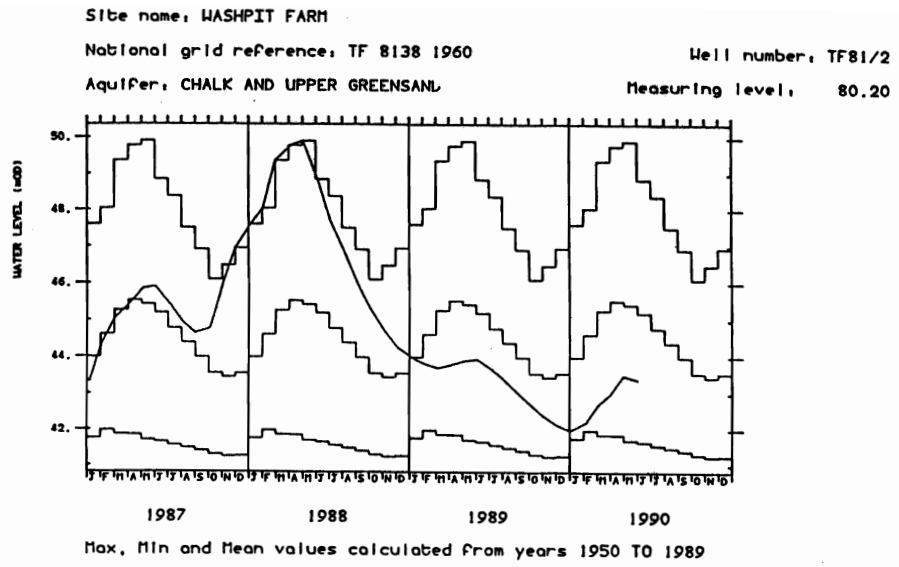


TABLE 4 A COMPARISON OF JUNE GROUNDWATER LEVELS: 1990 AND 1976

Borehole	Aquifer	Fisrt year of record	Av. May level	Jun 1976		Jun 1990		No. of years of record with Jun. levels <1990
				Day	level	Day	level	
Dalton Holme	C & U.G.	1889	18.31	26	13.69	28	13.58	4
L. Brocklesby	"	1926	14.31	4	6.23	27	7.61	2
Washpit Farm	"	1950	45.19	1	42.70	4	43.37	4
Rockley	"	1933	134.61	20	128.91*d*	25	132.61	13
Compton House	"	1894	39.08	30	29.06	26	34.31	11
L. Bucket Farm	"	1971	71.53	2	62.83	20	65.13	2
New Red Lion	L.L	1964	15.25	25	4.11	20	11.17	3

C & U.G. Chalk and Upper Greensand;
L.L Lincolnshire Limestone
PTS Permo - Triassic Sandstone
d Dry

FIGURE 4 LOCATION MAP OF GROUNDWATER INDEX WELLS

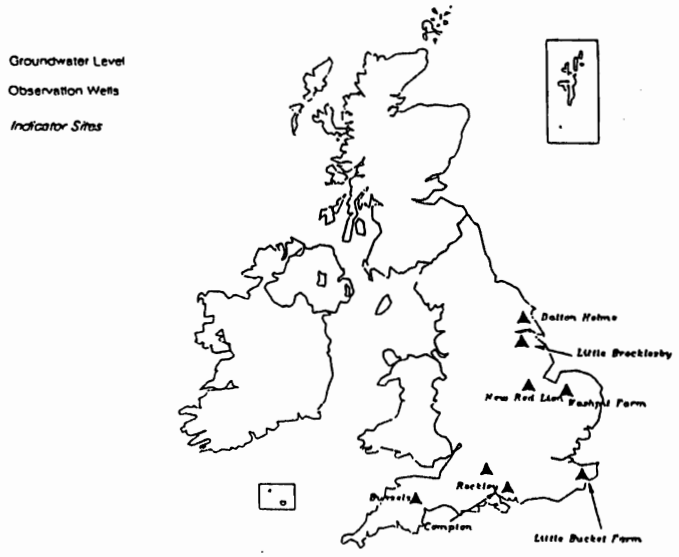
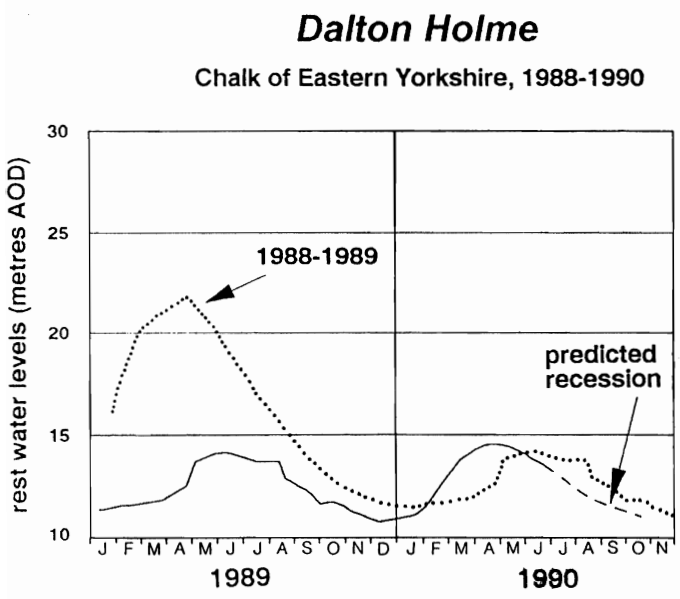
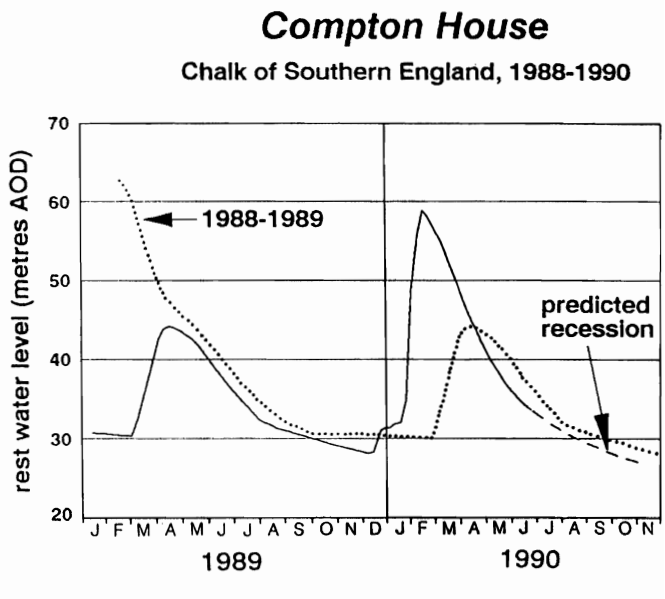


FIGURE 5 A COMPARISON BETWEEN THE 1988/89 AND 1989/90 GROUNDWATER LEVELS





APPENDIX A 1989 COUNTRYWIDE AND REGIONAL MONTHLY RAINFALL

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
England and Wales	mm	47	89	92	83	20	55	38	58	41	98	61	133	815
	%	55	137	156	143	30	90	52	65	49	118	63	149	89
Scotland	mm	206	239	188	63	53	76	49	184	96	187	60	96	1497
	%	150	230	204	70	58	83	44	143	70	126	42	62	105
NRA REGIONS														
North West	mm	75	142	144	87	37	82	33	116	29	145	84	100	1074
	%	67	175	200	113	45	99	32	93	24	123	69	83	88
Northumbrian	mm	31	85	63	58	22	51	19	77	20	71	35	75	607
	%	39	129	121	105	34	84	25	76	25	95	37	100	69
Severn Trent	mm	34	67	66	91	25	53	40	44	38	82	52	135	727
	%	49	126	127	175	39	95	62	54	57	126	66	193	94
Yorkshire	mm	27	70	78	78	19	69	43	41	20	77	45	98	665
	%	35	109	147	139	31	119	61	46	28	112	51	132	80
Anglia	mm	30	36	49	75	14	56	41	35	30	41	36	98	541
	%	58	86	123	188	30	114	72	55	58	79	58	185	89
Thames	mm	34	61	66	79	14	39	37	44	28	65	37	141	645
	%	55	130	143	172	25	75	62	63	45	102	51	214	92
Southern	mm	30	69	76	81	5	41	28	29	37	79	50	142	667
	%	39	121	146	169	9	82	47	40	52	101	53	175	84
Wessex	mm	43	94	90	77	21	32	37	43	49	101	58	165	810
	%	51	159	155	143	31	59	60	52	62	123	60	183	93
South West	mm	66	146	126	87	12	40	31	62	107	148	100	196	1121
	%	51	162	150	123	14	62	37	61	103	131	75	145	94
Welsh	mm	88	150	165	98	25	67	48	91	62	180	109	199	1282
	%	65	156	190	114	27	82	51	76	50	140	76	137	96
RIVER PURIFICATION BOARDS														
Highland	mm	319	355	233	60	68	90	65	222	118	252	79	109	1970
	%	195	267	204	53	66	82	51	150	75	135	47	56	114
North-East	mm	52	113	83	54	59	57	25	84	57	87	29	54	754
	%	57	153	134	89	77	81	27	79	66	90	28	53	74
Tay	mm	156	197	173	45	42	58	30	140	83	136	51	86	1197
	%	132	214	211	60	44	70	29	119	72	111	43	64	95
Forth	mm	133	158	151	44	36	64	27	144	69	112	39	79	1056
	%	134	205	219	65	43	85	28	124	64	106	36	72	95
Tweed	mm	71	105	105	48	43	51	23	113	47	68	30	78	782
	%	76	152	181	79	57	75	26	99	51	77	29	87	78
Solway	mm	139	157	195	87	35	71	42	176	77	145	59	119	1302
	%	99	169	214	99	38	79	38	135	51	101	41	79	91
Clyde	mm	232	262	229	82	46	90	63	252	120	244	73	107	1800
	%	144	232	218	80	47	87	48	177	69	133	44	58	108

Note: Final estimates of rainfall provided by the Meteorological Office.